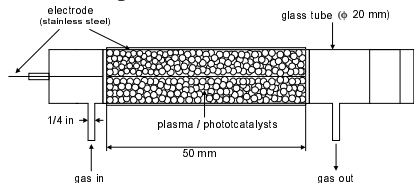


Decomposition of Toluene by TiO₂-based Photocatalysts Exited with Atmospheric Pressure Plasma

S.H. Chung, B.J. Kim, S. M. Cho
Department of Chemical Engineering, Sungkyunkwan University, Suwon 440-746, Korea

An experimental investigation for decomposition of toluene was carried out with TiO₂-based photocatalysts exited by atmospheric pressure plasma. The TiO₂ photocatalysts were known to be very effective for decomposition of volatile organic compounds (VOCs) upon the ultra-violet light excitation [1]. In this work, the TiO₂ photocatalysts were prepared and coated on glass beads, and then packed in a tubular catalytic reactor in which plasma was sustained at an atmospheric pressure. Toluene was selected for the experiment. The plasma is supposed to decompose the toluene at a certain amount by



itself. With the TiO₂ photocatalysts as well as the plasma, however, the decomposition of toluene is enhanced due to the catalytic action of the photocatalysts. Since the TiO₂ catalysts are directly excited by the U.V. light from the plasma, the photo-catalytic reactor system is efficient in that there is no need to excite the catalysts using additional U.V. lamps and the plasma itself decomposes the toluene in parts. Until now, the toluene decomposition was found to be about 20% with the plasma only, and it increased to about 30% with TiO₂ photocatalysts under plasma at a flow rate of about 0.5l/min (1000ppm of toluene).

In order to prepare the TiO₂ photocatalysts, titanium(IV) isopropoxide (TTIP) and isopropyl alcohol (IPA) were uniformly mixed with a molar ratio of 1:1 and subjected to react under nitrogen environment. Glass beads were then immersed in the solution to be coated uniformly on the surface.

After drying beads for 24 hours in an oven under wet condition, the beads were heat-treated at a temperature of 500 °C.

The reactor is tubular with diameter of 20mm and the length 300mm (the area where the catalysts packed and plasma generated is limited to 50mm). The concentration of toluene and the other gases were measured by gas chromatography and the mass spectrometer. The reactor is shown in Fig.1 schematically.

In this work, we report the effect of plasma and TiO₂ photocatalysts on the decomposition of toluene, separately, to elucidate the role of photocatalysts on the decomposition. The transient behavior of the normalized concentration of toluene is shown in Fig.2.

Fig.1.Schematic diagram of reactor [2].

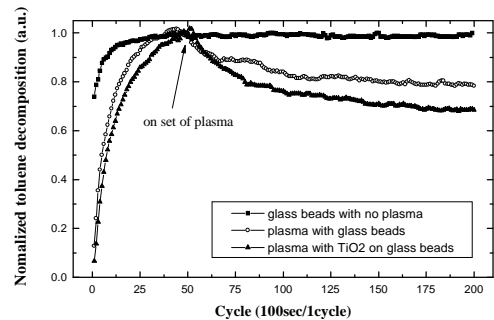


Fig.2.

Transient behavior of toluene concentration

Reference

- [1] J.Peral and D. F. Ollis, J. Catalysis, vol. 136, No.2,554(1992)
- [2] H.H. Kim, K. Tsunoda, S. Katsura, and A. Mizuno, IEEE Transaction on industry application, vol. 35, No.6(1999)